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University of Nebraska at Lincoln, cynthia.j.wiley@gmail.com

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HOME ON THE PLAINS:
AN EXAMINATION OF PLACE AT AGATE FOSSIL BEDS NATIONAL
MONUMENT THROUGH CHIPPED STONE TOOL ANALYSIS

By
Cynthia J. Wiley

A THESIS

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Major: Anthropology

Under the Supervision of Professor LuAnn Wandsnider

Lincoln, Nebraska

May, 2010

HOME ON THE PLAINS:
AN EXAMINATION OF PLACE AT AGATE FOSSIL BEDS NATIONAL
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Cynthia J. Wiley, M.A.

University of Nebraska, 2010

Advisor: LuAnn Wandsnider

Recent archaeological research in High Plains archaeology focuses on aspects of landscape and identifying areas that likely registered as “places” in the minds of past peoples. Agate Fossil Beds National Monument in Sioux County, Nebraska is located in an area wealthy in multi-component sites and a rich research history. Yet so many of the features common at neighboring sites are missing from this area. Based on what Agate Fossil Beds National Monument lacks, researchers refer to this area as transitional, merely a crossroads between places.

However, Agate Fossil Beds National Monument contains multiple desirable resources such as a perennial water supply (local springs and the Niobrara River), as well as tabular deposits of Upper Harrison Formation Moss Agate. Past research within the monument shows that past peoples occupied this portion of the Nebraska High Plains from the earliest known prehistoric archaeological culture until historic times. Was Agate Fossil Beds just a crossroads to other locations as has been suggested? Or did something else make this area a persistent destination for native peoples? This thesis relies on a landscape approach, as well as recent archaeological research investigating issues of time and place, with a chipped stone tool analysis to explore the answer to this problem.

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Any errors or omissions are mine and mine alone.

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CHAPTER 1 - INTRODUCTION

The aridity and difficult nature of the terrain on the Great Plains led early scholars to believe that the region could not have been inhabited by Native American groups prior to the introduction of the horse (Wood 1998). According to Wood, this attitude prevailed in the early twentieth century and persisted among a few researchers as late as the 1970s. Archaeologists and other Great Plains scholars have expended much effort in the intervening time gathering evidence of a contradictory situation—that the Great Plains region has a long and vibrant history of occupation existing thousands of years prior to the arrival of Europeans on the continent. However, larger questions regarding the pre-Columbian occupation of the Plains region, particularly the High Plains area, abound. One particularly pertinent issue revolves around the idea of “place,” with its connotations of ownership and identity (Cresswell 2004), and how past peoples recognized places or landscapes, i.e., as areas of particular resource extraction or as locations of mythological events or historical significance.

Recent works included in an edited volume by Scheiber and Clark (2008) and research by other archaeologists interested in landscape issues (e.g. Athanassopoulos and Wandsnider 2004; Bender 1992; Ingold 1993) comment on the dynamic relationship between the land and the past peoples living actively upon it. This is in opposition to past approaches that used archaeology as a tool to examine frozen moments in time through objects and deposits without necessarily considering the individuals who actively constructed the landscape on which they lived. Adding to this new focus on dynamic

individuals, cultural geographers heavily influenced the anthropological and archaeological recognition of the landscape as more than simply a series of individual activity sites and occasional isolated finds. The influential new research focused on how humans become rooted in or uprooted from a particular place (Feld and Basso 1996). In particular, researchers seek to “expose artificial boundaries and unnecessary dichotomies—between history and prehistory, nature and culture, environmental archaeology and built environments, processual and post-processual archaeologists, and time and space—and to bridge the gaps between them” (Clark and Scheiber 2008:7).

This thesis also builds upon recent work utilizing a landscape archaeology approach. Osborn and Kornfeld (2003) utilize a landscape ecology perspective to explore the Great Plains in terms of adaptable resource islands, thus de-homogenizing regional resources and requiring the inclusion of a conscious human element in standard theories about seasonal rounds and other resource extraction patterns. In a regional examination of the Black Hills, Kornfeld (2003) attempts to integrate artifact studies into an economic model in a way that incorporates multiple resources and presents the area as one of interactive needs rather than individual material targets. Clark and Scheiber (2008) go one step beyond simply attempting to recognize the dynamic nature of resource extraction. Their work illustrates the depth of information available through an examination of an area for places that persisted (*sensu* Schlanger 1992) over a long period of time.

This recognition of the active nature of landscape is present throughout the contributions to Scheiber and Clark’s (2008) volume on High Plains landscapes.

Scheiber (2008) examines the way a sense of “place” contributes to discard patterns through re-use of the landscape, specifically the organization of space, at the Donovan Site in Northeastern Colorado. Mitchell (2008) utilizes the presence of features related to recurrent feasting to look at how places were made by groups. Clark (2008) examines landscape through the lens of individual sites as specific places focused on native plant availability. Burger, Todd, and Burnett (2008) consider landscape taphonomy and how landscape patterning develops owed to multiple agents.

This thesis differs from previous research in multiple ways. Bamforth and colleagues (2005) utilized integrated spatial information to determine that individuals use perceivable remnants of past occupations in the creation of current features on the landscape (see also Wandsnider 2008). From this, they argue that Folsom individuals at the Allen Site were mapping on to previously constructed features when building new hearths and associated structures. In a similar manner, Mitchell (2008) interprets the rare, but unusually large concentrations of heat-altered rock as evidence that particular spaces in the Upper Arkansas River basin were *made* places through recurrent feasting ceremonies.

In turn, the research presented here is an effort to understand how past individuals may have constructed Agate Fossil Beds National Monument (hereafter referred to as Agate Fossil Beds) as a place on the Nebraska High Plains. In the recent Historic Resource Inventory of the monument, Evans-Hatch (2008) interprets the lack of bone beds, apparent butchering areas, or large occupational sites as indicating that Agate Fossil Beds was simply a transitional location between places. To address the veracity of this

interpretation, this thesis utilizes a tool-life history analysis of chipped stone tools to explore whether Agate Fossil Beds was merely a different kind of place to past peoples.

This study focuses on prehistoric sites located within the boundaries of Agate Fossil Beds National Monument (National Park Service) in central Sioux County, Nebraska (Figure 1.1). The area includes both a local source of lithic raw material (Upper Harrison Moss Agate) and a riverine system (Niobrara River and multiple ephemeral drainages from the hills) within the park boundaries. During past investigations, the majority of artifacts were documented during pedestrian surveys and surface collections. Previous archaeological work in conjunction with narratives by the original Euroamerican

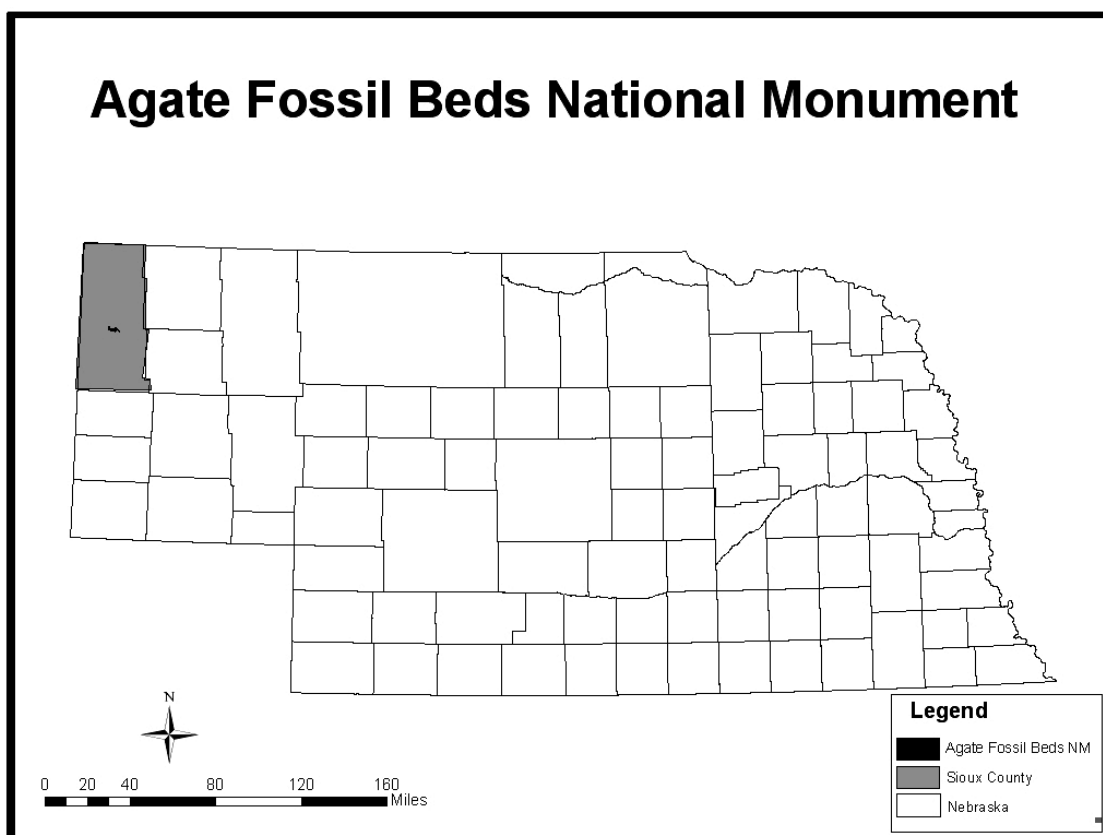


Figure 1.1. Map showing location of study area. Created by Albert M. LeBeau, III.

homesteaders suggest an enduring presence in this area by indigenous peoples.

Utilizing quantitative data, raw material types, available temporal associations (based upon projectile point type), and the intensity of use prior to final discard and discard location, this research sheds light on the creation and persistence of places on the landscape of Agate Fossil Beds and the larger Nebraska High Plains. Unfortunately, comparable chipped stone tool data is not available for other High Plains sites and definitive conclusions cannot be formed. The preliminary data is presented here in an effort to begin the process of utilizing chipped stone tool-life histories to understand the presence of place at Agate Fossil Beds.

Due to the finite resources available, archaeologists should make an effort to utilize previously collected archaeological materials to address new issues and to apply new research methods. Bamforth and Becker's (2000) work with materials from the now-destroyed Allen Site provides an excellent example. This thesis also serves as an example of how the accumulation of multiple investigations within a particular area by numerous individuals is available to be combined in the use of new research, giving new life to old collections.

Overview of Thesis

Chapter two provides an overview of the current thought on "place" and persistent places in archaeology, as well as how time is communicated and considered within archaeology. In order to provide an understanding of the physical and known cultural

landscapes of Agate Fossil Beds, chapter three presents a background of the monument, both as a created National Park unit and as a unique archaeological, environmental and geologic location. Chapter four details the types of materials included in the study, as well as the methods utilized. Chapter five enumerates the results of this examination of materials and discusses the implications created. Finally, chapter six summarizes the thesis, identifying directions for future research in this area.

CHAPTER 2 – PLACE AND LANDSCAPE

“The landscape is never inert; people engage with it, re-work it, appropriate and contest it. It is part of the way in which identities are created and disputed, whether as individual, group, or nation-state” [Bender 1993:3].

Introduction

Archaeology on the Great Plains has traditionally focuses on mobility models, resource extraction, and creating a culture history chronology for various regions of the Great Plains. Although this is all vital and important information to Plains archaeologists, little focus until recently was placed on the past individuals inhabiting the Great Plains at these points in prehistory and history beyond their identity as members of an “archaeological culture.” Chapter one presents the problem of examining “place” at Agate Fossil Beds, an area that has been dismissed as transitional and described largely in terms of what is not present archaeologically (Evans-Hatch 2008). In order to address this issue and attempt to “see” place, the ensuing analysis will incorporate the related approaches of landscape archaeology, time perspectivism, and studies of place theory. This chapter briefly summarizes each approach. In particular, this chapter explores how these approaches ground the chipped stone tool analysis in an examination of whether Agate Fossil Beds was just a crossroads between places or whether this area became a place to past peoples.

Landscape Archaeology

The landscape is not land, nature, nor space, but rather the “world as it is known to those who dwell therein, who inhabit its places and journey along the paths connecting them” (Ingold 1993:156). It reflects the trans-temporal interactions between individuals and different aspects of their environment, physical and cultural. Emerging from settlement archaeology (see Kantner 2008), landscape archaeology is the study of “meanings that prehistoric landscapes had for the people who inhabited or used them and how these understandings channeled human activity” (Trigger 2006:473). Landscape archaeology, then, has come to include not only the world and how humans interact with it, but also the very way in which humans construct their world (Anschuetz et al. 2001; Athanassopoulos and Wandsnider 2004; Knapp and Ashmore 1999).

Archaeologists are increasingly prepared to examine through landscape theory the way social, ritual (including sacred), economic, and ecological means interface. According to Renfrew and Bahn (2000), current archaeological landscape studies include regional surveys in an effort to recognize that the presence of evidence beyond the traditional boundaries of a site that may yield information about the interaction between individuals and their surroundings. This is becoming more common as archaeologists engage in site-less or nonsite archaeology (Kantner 2008; Knapp and Ashmore 1999; Mandel 2000; Renfrew and Bahn 2000).

Yet according to Trigger (2006), archaeology has been slow to incorporate traditional ecology into landscape archaeology, choosing instead to focus on only the cultural aspects, and not on the interplay between factors. Osborn and Kornfeld (2003)

provide a way to reincorporate ecological aspects into landscape archaeology through an understanding of how expectations regarding the utilization of ecological islands create expectations about behavior and the associated material record. A multi-faceted landscape approach is necessary in order to best inform archaeological interpretations within the processual/post-processual continuum; although various aspects of landscape can be identified, they are intertwined and cannot be studied in complete isolation.

Brunswick's (2003) research is also pertinent to this topic. His approach to high- and low-density patch utilization on the Coloradoan High Plains reveals that resource patches with high density tend to reveal persistence, stability and resilience of occupation through environmental fluctuations and time. The perennial nature of the Niobrara River may have created a high density resource patch at Agate Fossil Beds, repeatedly attracting people to this area of the High Plains. In the Sandhills located east of Agate Fossil Beds, the presence of an aquifer mitigated climatic fluctuations (Koch and Bozell 2003). The Niobrara River and associated springs such as Agate Springs, located west of the monument boundary, likely performed the same service for this area.

Time

In order to apply a holistic view of landscape and all its incorporated factors to Agate Fossil Beds, this thesis will also include elements of time perspectivism (see Bailey 2007; Holdaway and Wandsnider 2008). Just as archaeologists should not be trapped into a one dimensional view of the landscape, we also must not consider time as a static monotypic concept. Time works on multiscalar levels (Bailey 2007), including the long-term (i.e., geologic epochs) and short-term (e.g., historical eras; Knapp 1999).

Binford (1981) and Schiffer (1985) expended a great deal of effort accusing each other of operating under the “Pompeii premise,” the failure to recognize the inherent palimpsest present in any archaeological deposit. Even with the growing body of research in time perspectivism, change in the practice of archaeology remains slow. The chronology which archaeologists impose on past peoples attempts to incorporate environmental and artifactual evidence, but still maintains a calendrical basis. Archaeologists continue to utilize these chronologies for lack of a better common unit, even as they seek to look beyond arbitrary temporal boundaries and acknowledge the constant rate of change.

However, knowledge of the landscape, even with environmental fluctuations, does not operate with an expiration date at which point the knowledge is lost. Social or collective memory, transmitted between generations and groups of people, transcends the frozen snapshots so often examined by archaeologists. Correlations between oral mythology and archaeology sites were an exciting avenue of research in the early twentieth century (i.e., Montague 1944; Strong 1934). Though interest in this area of research waned for decades, archaeological investigations incorporating oral tradition (Echo-Hawk 1997, 2000; Hull 2005) and mnemonic devices (Smith and McNees 1999) is resurging in light of new interest in landscape archaeology. This resurgence is also present in light of Wandsnider’s (2008) emphasis on integrated spatial information that explores how individuals map on to their surroundings through both natural and cultural structures.

Potential soil deflation of the area during the early twentieth century (Kornfeld and Larson 2009) may have created palimpsest deposits at Agate Fossil Beds whereby areas that were once rich deposits are now classified as lithic scatters and uninteresting to

many investigators. Classifying the projectile points and any other diagnostic stone tools at Agate Fossil Beds allows for a general understanding of the temporal depth of human interaction with this landscape, but does not inform on specific pulses of use. Nor does artifact chronology inform on when the area may have become a place unless artifacts can be associated with specific features (see Mitchell 2008).

Place

The social aspects of landscape archaeology examine how individuals' interactions with their surroundings work to create a social identity for the individual and the larger group through the intersection of sacred landscape, environmental conditions, traditions, origins and folklores, and private perceptions (Cooney 1999). Knapp (1999:231) argues that the natural world – including vegetation, landforms and minerals – may be “defined and interpreted through social practices and experience.” Social landscapes can crosscut topographic and ecological zones – remaining a somewhat ambiguous concept (Cooney 1999; Stone 2003). Yet, the creation of a specific social landscape in a space is where the creation of “place” occurs.

This space is continually transformed into “place” through interactions with the individuals living upon the land. The concept of persistent places, “place[s] that [are] used repeatedly during the long-term occupation of a region” (Schlanger 1992:92), is useful for incorporating extensive sites with isolated finds. Furthermore, a study of place assists archaeologists seeking to move beyond traditional topics of analysis by acknowledging that “place is also a way of seeing, knowing and understanding the world” (Cresswell 2004:11). This approach allows one to look beyond the presence or

absence of particular activities in a location or what particular resources may be available within the area, a particularly relevant issue at Agate Fossil Beds due to the lack of the characteristic High Plains bone bed and/or butchering camp and relatively small size of the study area.

Landscape archaeology and an examination of persistent places are particularly relevant on the High Plains due to the perceived difficulty of resource exploitation. Osborn and Kornfeld (2003) have explored the idea of examining areas such as the Great Plains in terms of resource islands with varying qualities of attractiveness. Kornfeld (2003) also found resource distribution varied by ecozone in the nearby Black Hills. Considering resources as existing in variable islands or ecozones and how past people interacted with these resource areas can add to traditional artifact analyses in identifying persistent places (*sensu* Schlanger 1992).

However, Kornfeld's approach does not allow for cultural attachment to a place beyond the available physical resources. Though this is difficult to see archaeologically, recognizing possible cultural attachment to a place is necessary to the landscape archaeology approach both due to its interaction with the physical landscape and in how humans negotiate their physical landscape—e.g., spiritual and cultural constraints on travel and exploitation of a particular area (Clark and Scheiber 2008; Cresswell 2004; see also Dunning et al. 1992).

Evans-Hatch (2008) describes Agate Fossil Beds as a potential crossroads, or transitional zone between other areas, i.e. a path between specific places. However,

Agate Fossil Beds has a narrative landscape (*sensu* Scheiber 2008) upon which individuals potentially created place through their construction of the landscape (Mitchell 2008). Although prior archaeological investigations did not uncover the major habitation sites or butchering camps expected due to Agate Fossil Beds' close physical location to other major sites, examinations of landscape, time, and place are used to access the long use-life of this area.

Place through Chipped Stone

How and why places develop and persist on the landscape, lithic analysis, particularly the analysis of chipped stone tools, is a useful resource to consider. As chipped stone tools are used and modified, their attributes are necessarily modified as well (Andrefsky 2005). In this way, stone tools not only present a temporal element with regards to their stylistic attributes, but also in the intensity of use through breakage and remodeling prior to their final deposition.

Holdaway and colleagues (2008) argue that traditional resource models focus and depend on the view that past environments were stable rather than undergoing rapid fluctuation. They instead choose to recognize that not only were past environments in flux, but also the conditions of the archaeological record. In order to investigate the occupational history and use of a particular area in western New South Wales, Australia, Holdaway and colleagues (2008) utilize lithic artifacts and remnants of heat retainer hearths in the absence of the traditionally seriating projectile points. The hearth

chronology revealed that individuals appear to have left the study area for hundreds of years at a time. Through stone tool analysis, Holdaway and colleagues (2008) posit that the more often a place is visited in terms of total time, the higher the number of deposited artifacts displaying a long tool-life history. From these results, they suggest that archaeologists must focus on the variability present in the archaeological record rather than constraining their research to false notions of stability.

Holdaway and colleagues' research informs this study at Agate Fossil Beds with respect to the examination of tool-life history. At Agate Fossil Beds, occupational history is understood based largely on the projectile points recovered during archaeological investigations of the past 50 years. As has been shown, these fossil index artifacts often represent multiple centuries of occupation but cannot account for potential lapses in visitation. Based on the research from western New South Wales, an examination of the tool-life history at Agate Fossil Beds has the ability to inform on the intensity of occupation.

Summary

Perhaps Cooney (1999:47) provides the mindset archaeologists should employ when considering the landscapes of prehistoric peoples: "we cannot hope to think like a prehistoric person did about their landscape but we can construct an overview of what the elements of that landscape may have been and then try to understand what they meant for the people were carrying this landscape around in their heads." Knapp (1999) states that if archaeologists can understand but a small portion of what creates certain aspects of a

landscape, they can gain insight into the mindset of the individuals who once inhabited the region.

In an attempt to access aspects of the prehistoric landscape at Agate Fossil Beds, this thesis utilizes a landscape archaeology approach with elements of time perspectivism and notions of place in conjunction with a quantitative analysis of chipped stone tools. Agate Fossil Beds contains multiple desirable resources such as a perennial water supply (local springs and the Niobrara River), as well as tabular deposits of Upper Harrison Formation moss agate. However, the local water supplies likely varied greatly in flow corresponding with local climatic changes and the moss agate is of relatively poor quality compared to other local lithic sources. Was Agate Fossil Beds just a crossroads to other locations as has been speculated (i.e., Evans-Hatch 2008)? Or did something else make this area a persistent destination for native peoples? Perhaps other types of place exist and have yet to be recognized in the archaeological record.

CHAPTER 3 - AGATE FOSSIL BEDS AND HIGH PLAINS ARCHAEOLOGY

Introduction

Agate Fossil Beds is located in central Sioux County, the northwestern-most county in Nebraska. Due to its location in an area of “high variance” with regards to both climate and geography (Wandsnider 1999:9), Agate Fossil Beds has a unique history of occupation and research that in the past created disparate portraits of life in the area. Previous research provides only a glimpse into the prehistoric past in this place and much of what is known about the location is due to investigations of the surrounding area. This chapter presents an overview of the environment of Agate Fossil Beds, as well as a background of area archaeology-both specific to the monument and generally of the High Plains. Finally, expectations for the chipped stone analysis included in this thesis are provided, as indicated by past archaeological research in the vicinity.

Environment

As noted by Frison (1998), the idea that the Great Plains consists only of monotonously flat grasslands is immediately dispelled upon examination of the environment contained within the Northwestern and Northern Great Plains. The Nebraska High Plains is a unique area consisting geopolitically only of Sioux, Dawes, and Scotts Bluff Counties. The western edge of the Nebraska Sandhills is directly to the east. The Pine Ridge extends along the northern edge of the area and serves as the boundary between the High Plains and the Missouri Plateau to the north (Greenslet

1929). This intersection of multiple landforms, including a lobe of badlands more commonly associated with South Dakota, has created an area of great geographic diversity.

Agate Fossil Beds is located approximately 1,341 m (4,400 ft) above sea level–1,338 m (4,390 ft) at the valley bottom and 1,402 m (4,600 ft) above sea level at the summit of surrounding hills—and is on the Dawes Table, a “sharply rolling” (Evans-Hatch 2008:6) tableland located north of the Niobrara River (Bozell 2004). The Niobrara River separates the Dawes Table from the Box Butte Table south of the river. The modern 450-mile Niobrara River has its origins outside of Lusk, Wyoming (about 104 km or 65 mi northwest of Agate Fossil Beds) and drains into the Missouri River on the northeastern border of Nebraska (Bozell 2004; Evans-Hatch 2008; Nickel 2002). Approximately 6.5 km (4 mi) of the Niobrara River valley and small drainages lie within the boundaries of Agate Fossil Beds (Nickel 2002; Figure 3.1). The Niobrara passes through Sioux County, and many other creeks including the Big Cottonwood, Little Cottonwood, Sand and Hat Creeks disperse water from springs and other sources throughout the area. This makes the Niobrara River the only perennial body of water between the North Platte River to the south and the White River in northern Sioux County (Nickel 2002). Within the confines of Agate Fossil Beds, the Niobrara is relatively small, only a few meters wide, and resembles more of a marsh than a flowing stream during parts of the year (Bozell 2004).

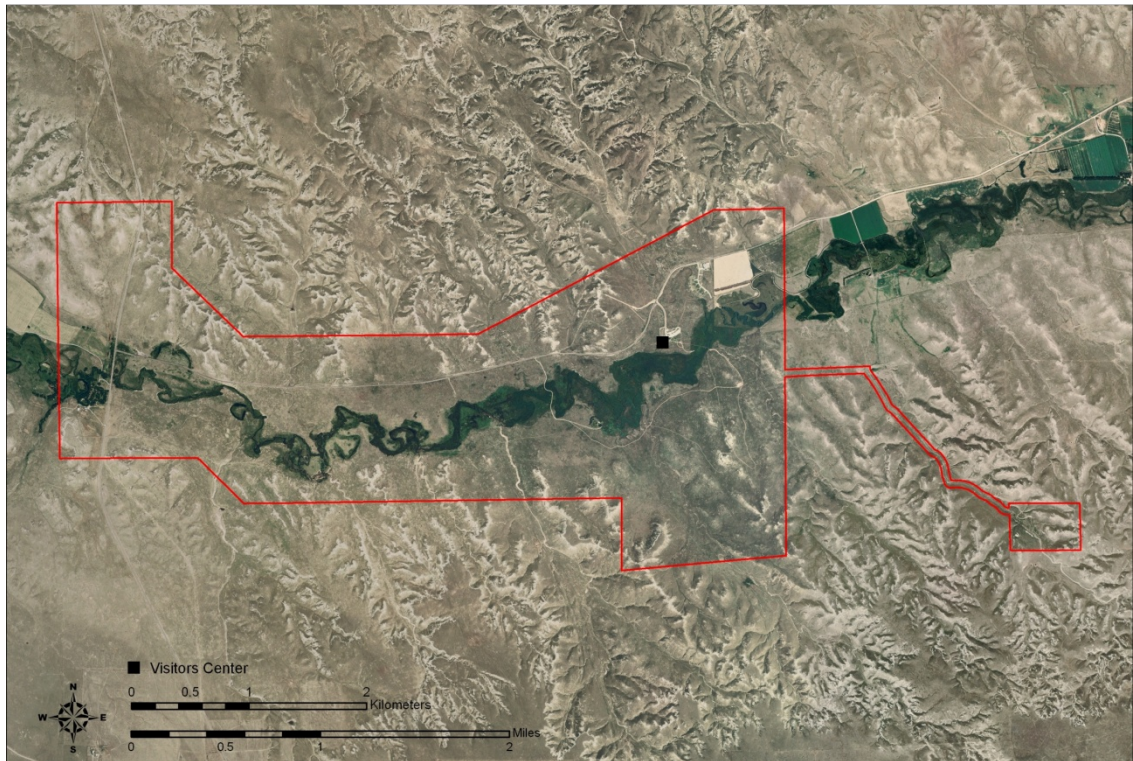


Figure 3.1. The section of the Niobrara River contained within monument boundaries. Courtesy of Melissa A. Baier (National Park Service; source: USGS).

As the Niobrara River meandered over the past thousands of years, it cut the cone-shaped hills that rise above the floodplain (Evans-Hatch 2008:6). Paleontologists and amateur fossil collectors investigated two of those hills, specifically Carnegie and University Hills, during the twentieth century due to the rich deposits of 19.2 million year old fossils that are exposed or easily accessible to excavation (Bozell 2004; Evans-Hatch 2008). According to Bozell (2004), Miocene-age Ogallala formation deposits are the primary deposits at Agate Fossil Beds. For a summary of the pre-Quaternary geology and paleontological finds at Agate Fossil Beds, see Evans-Hatch (2008) or Hunt (1978).

The modern climate of Agate Fossil Beds exhibits distinct extremes between the hot, dry summers reaching highs over 38°C (100° F) and cold, dry and windy winters that regularly reach lows below freezing (Bozell 2004; Evans-Hatch 2008; Nickel 2002). Yearly rainfall ranges widely between 15 and 76 cm (6-30 in), but with averages between 38 and 44 cm (15-17 in) per year; the distribution of rainfall also varies greatly over the region (Bozell 2004). The semi-arid nature of the area is a result of its proximity to the Rocky Mountains, which block Pacific moisture from crossing the continent (Evans-Hatch 2008). These semi-arid conditions reinforce the importance of local springs and the Niobrara River to both fauna and humans living in the vicinity of Agate Fossil Beds (Wandsnider and MacDonell 1997). The variation present in modern climatic conditions was also present in the past and likely affected past peoples and their economic strategies (Frison et al. 1996).

Both Evans-Hatch (2008) and Kay (1998) provide detailed descriptions of major climatic episodes on the Great Plains and the effect of fluctuations between cooler, moister conditions and the warming, drier effect on vegetation, particularly the shift from forests to drought-tolerant grasses. Wandsnider (1999:12) has summarized three important trends in paleoclimatic data for the Holocene High Plains:

First, generally more mesic and possibly cooler conditions prevailed on the High Plains during the first millennium A.D.; and, these conditions were followed by more xeric conditions late in the first millennium A.D. Second, the mesic conditions were not homogenous and continuous; instead, they were varied and interrupted by several periods of relatively xeric conditions. Third, while similar trends in paleoclimate were seen on the High Plains and on adjoining areas, moisture or temperature regimes were not tightly coupled between regions.

Agate Fossil Beds is typical of the mammoth grassland of the High Plains that extends from the Saskatchewan River drainage in Alberta, Canada to the Rio Grande River at the Mexican border (Evans-Hatch 2008). Vegetation generally consists of perennial mixed and short grasses—i.e. “short xeric-adapted sod-forming grasses, short grass-like sedges, and medium-height prairie grasses” (Nickel 2002:3)—that renew every spring after dying off each winter (Bozell 2004; Evans-Hatch 2008). Other flora include cacti, yucca, buffaloberry, wild plum, wild cherry, currant, gooseberry, cattail, sand cherry (Clark 1993; Nickel 2002). Homesteaders introduced deciduous trees such as cottonwoods and willows along local water sources; both deciduous and coniferous trees are available in the Black Hills north of Agate Fossil Beds (Bozell 2004; Clark 1993; Evans-Hatch 2008; Frison et al. 1996; Nickel 2002). Range-land agriculture encouraged the retention of hardy native grasses in Sioux County over introduced European varieties (Evans-Hatch 2008). However, this is not to imply that the vegetation at Agate Fossil Beds remains authentic pre-contact natural landscape. Fires (non-human and human sourced), bovine grazing, and the limited agriculture necessary for the subsistence of the ranchers created a complex landscape that has sustained a multitude of changes and in no way constitutes a “natural environment” (Evans-Hatch 2008:12-13).

The woodland corridor created by the Niobrara River provides a transitional environment for mammals and birds from bordering regions to congregate in Agate Fossil Beds (Evans-Hatch 2008). In both prehistoric and historic times, mammal populations included elk, bison, mule deer, pronghorn antelope, prairie dogs, gophers,

badgers, coyote, fox, rabbit, raccoon, and turtles; fish, waterfowl, grouse, and raptors were likely present as well (Bozell 2004; Clark 1993).

High Plains Archaeology

Professional (as opposed to avocational) archaeological research in Nebraska began in the early twentieth century. In the 1920s and 1930s, paleontologists on the Morrill explorations from the University of Nebraska State Museum reported many sites to archaeologists or in some cases proceeded to conduct archaeological investigations as part of their paleontological work (May 2000). In the 1930s, William D. Strong, an archaeologist with the University of Nebraska and the Bureau of American Ethnology, conducted research attempting to connect mythologies and traditions of Native Americans to archaeological evidence (Strong 1934). After 1940, the previous collaborations between archaeological and geologic (paleontological) expeditions diminished as archaeologists focused their attention on late Prehistoric sites, erroneously believing geologic depositional analysis was unnecessary for these sites. Collaboration revived in the 1960s as archaeological theory focused on reincorporating the sciences (Mandel 2000). Geoarchaeology became routine in Plains archaeology in the 1970s and 1980s (Mandel 2000).

As part of Franklin D. Roosevelt's New Deal, Works Project Administration employees investigated rockshelters in western South Dakota (Frison et al. 1996). However, archaeology on the Great Plains really began to receive recognition with the creation of the Smithsonian Institute River Basin Surveys in response to the Flood Act of 1944. Thousands of miles of riverbanks and proposed reservoir locations were

investigated and salvage archaeology entered mainstream archaeology (Frison et al. 1996). The River Basin Surveys continued from the early 1950s to the early 1960s, at which time archaeologists were incorporated into government agencies as permanent employees due to new laws requiring archaeological investigations as part of federally funded projects.

During the late 1950s, archaeologists attempted to create a cultural chronology for Great Plains prehistory that encompassed the entire region. According to Frison and colleagues (1996), Mulloy (1958) based one of the earliest organizational chronologies on the excavations at Pictograph Cave in southern Montana. Reeves (1973) attempted to improve Mulloy's effort by incorporating more data from the Northern and Central Plains and defining traditions and phases. However, Frison (1991) recognized that the variability present in the archaeological record of the Great Plains necessitated a more tailored chronology for individual sub-regions (Frison et al. 1996).

Much of the archeological research conducted on the High Plains has related to bison kill sites and bone beds due to a local research focus on mobility. The Hell Gap Site is located in southeastern Wyoming where the open Plains meet the Hartville Uplift. Though the Hell Gap site has a long history of excavation and is the type site for three paleo-projectile points, little information was published on this site until recently when the site was re-excavated (Kornfeld and Larson 2009). The Casper Site on the North Platte River near Casper, Wyoming is a late fall Hell Gap bison kill site consisting of a parabolic sand dune bison trap where the animals were killed and an associated butchering camp (Frison 1974). The use of natural features of the physical landscape for

bison kills is commonly found on the High Plains. The Olsen-Chubbock site in East-central Colorado includes an arroyo into which bison were stampeded; the Finley Site in Wyoming incorporated a parabolic sand dune similar to that at the Casper Site (Frison 1974). In 1972, Frison (1974, n.d.) investigated the Hawken Site which contains a bison trip in the form of a steep, narrow arroyo box canyon. The Agate Basin Site is located in Wyoming on the western fringes of the Black Hills. This site also includes a bison kill in a steep dry arroyo, leading Frison (1982) to suggest that this was likely a common method of communal hunting on the High Plains and the full perception of this trend is obscured by differential preservation. Northern Sioux County, Nebraska is home to one of the most well-known Paleoindian bison bone beds in the United States, Hudson-Meng. Due to its proximity with other documented High Plains Paleoindian sites in Colorado, Wyoming, and South Dakota, much of the archaeological focus in this area has been on Paleoindian artifacts (e.g. Agenbroad's 1973-1974 Hat Creek Drainage Survey; Agenbroad 1989). However, there is a dearth of information beyond paleosites available for the Nebraska High Plains due to its perceived transitional location.

In the last two decades, in large part due to Kornfeld (e.g., 2003, 2007; Kornfeld and Osborn 2003; Kornfeld et al. 1990), new research has focused on extending resource extraction models beyond the focus on large animal procurement to a broader subsistence strategy. Landscape archaeology has also played a large role in expanding interest in High Plains archaeology beyond bison kill sites (see Kornfeld and Osborn 2003 volume; Scheiber and Clark 2008 volume; Wandsnider 1999). Bamforth and Becker (2000) and

Kornfeld and Larson (2009) exhibit a new movement on the High Plains to revisit past archaeological investigations in search of new information.

In general, inhabitants of the Nebraska High Plains are believed to have been nomadic foragers seeking to utilize the area's resources (Bozell 2004; Evans-Hatch 2008; Wandsnider and MacDonell 1997). This is in contrast to what archaeologists once considered to be the conditions-that nomads consisted of a poor, starving populace or were inferior (Frison 1998; Wandsnider and MacDonell 1997). Kornfeld (2003:7-8) argues indicates that "affluent foragers" traversed the High Plains in search of a wide variety of subsistence resources but were not dependent on bison (see also Kornfeld and Larson 2007). Three protracted droughts on the High Plains during the late fifteenth and early sixteenth centuries are believed to have caused Plains villagers elsewhere to disperse and temporarily form "semipermanent villages" in the Niobrara River valley (Evans-Hatch 2008:30). How this affected local nomadic groups is not currently understood.

Evans-Hatch (2008) provides a summary of Northwest Plains and Central Plains chronology as it may apply to Agate Fossil Beds based on evidence from various archaeological investigations (see also Bozell 2004). The specific prehistoric culture-history of Agate Fossil Beds is unclear and requires further investigation. The following summarizes what is known:

Despite thousands of years of human activity moving around the High Plains, there is surprisingly little physical evidence of prehistoric habitation at Agate Fossil Beds National Monument. Scatters of projectile points, stone flakes, tools, and potsherds representing stages of culture from the Paleo-Indians to the Central Plains tradition have been identified throughout the park, especially on the Niobrara valley floor, upland

terraces, and butte tops. But the large hunting and butchering camps, permanent houses, and burial sites that have been found in eastern Wyoming, southern Nebraska, Western South Dakota, and southeastern Montana, have eluded archeologists at Agate [Fossil Beds]. Perhaps this portion of the Niobrara was just a place to pass through—a transitional zone between wet and dry, where nomadic hunting and gathering were favored over a sedentary life—or perhaps a major campsite corresponds with the developed location of Agate Springs Ranch¹ itself” [Evans-Hatch 2008:15].

Currently, archaeological evidence also suggests that because of the small size and flow of the Niobrara River in the vicinity of Agate Fossil Beds, the area was of little interest to either English or French fur traders, even though traders from Santa Fe were in regular contact with other native groups in Nebraska. Europeans likely did not regularly encounter individuals in the Agate Fossil Beds area until after the Louisiana Purchase in 1803 (Evans-Hatch 2008).

Background of Agate Fossil Beds

In 2008, Gail Evans-Hatch completed an historic research study on Agate Fossil Beds for the National Park Service. The following, except where noted otherwise, is sourced from this study. Agate Fossil Beds National Monument was designated in 1965 by an act of Congress (Public Law 89-33) with the intent to “protect, preserve, and interpret the scientific, paleontological specimens, and geological features concentrated at University and Carnegie Hills, and the Indian artifacts and relics collected by James Cook, long time rancher at Agate Springs” (Evans-Hatch 2008:2). Due to bureaucratic and funding difficulties, Agate Fossil Beds was not formally established until 1997 and

¹ Agate Springs Ranch consists of the home and outbuildings retained by the Cook family after the creation of Agate Fossil Beds National Monument. The ranch adjoins the western monument boundary and is visible from the monument entrance.

remains administratively associated with Scotts Bluff National Monument (Bozell 2004).

Agate Fossil Beds consists of 3,057.87 acres in two separate units: the main unit that is available to the public through roads and trails, and the *Stenomylus* Quarry southeast of the main unit and improved by neither public road nor trail. Both the Niobrara River bottom and the surrounding uplands are included within monument boundaries.

Buildings consist of the visitors center, staff housing, and several historic structures such as the “Bone Cabin”—a small cabin routinely used by the early paleontological crews investigating the fossil quarries.

Most of the land now incorporated within park boundaries was initially a part of Agate Springs Ranch. Elisha B. Graham first homesteaded the 0 4 Ranch (near the modern Agate Springs Ranch) in the late 1870s. Graham’s daughter, Kate, married James H. Cook in 1886, and they subsequently bought the ranch in 1887, renaming it Agate Springs Ranch after the local springs (Bozell 2004). Cook altered the landscape at Agate Fossil Beds in myriad ways. Not only was Agate Springs Ranch a cattle establishment, but Cook also had approximately one thousand acres in alfalfa and potatoes at various times. Cook dug two irrigation ditches and dredged a backwater inlet of the Niobrara River to make a pleasure pond. This was in addition to planting many trees along the waterway an orchard near the ranch house. Fossil quarry excavations greatly altered the topography of the five fossil-bearing hills: Carnegie Hill, University Hill, Amherst Hill, Beardog Hill and North Ridge.

Fossil quarry investigations intensified in the early 1900s, encouraged by the Cook family who provided not only access to researchers from the University of

Nebraska, Yale University, etc. but also parking space and refreshments to the pleasure-seeking public. At one point the Cook family created the Cook Family Museum of Natural History on their porch to display various fossils and Native American stone tools that were collected on the ranch, as well as Cook's ethnographic collections. The Cook family also allowed members of the public to do their own fossil and artifact collection, a practice that is continued by some area ranchers on their lands to this day.

In 1917, Agate Spring Ranch briefly enjoyed a wider air of notoriety when Harold J. Cook—Kate and James' son and a University of Nebraska paleontologist—found the tooth of an extinct peccary. However, Harold Cook and others initially believed the tooth to be from a new anthropoid, *Hesperopithecus haroldcookii* ("Nebraska Man"). This new "anthropoid" was an exciting find at the time due to the then contemporary debate over evolution and the ongoing Scopes Monkey Trial.

Located near the South Dakota border, Cook was in contact with several Cheyenne and Lakota leaders; he allowed these native groups to return to the ranch, which constituted a portion of their former lands for encampments and rituals. In particular, Cook maintained a close relationship with Red Cloud, a Lakota leader. As a result of this relationship, Cook received moccasins, beaded bags, and other objects of ethnographic interest (Wandsnider and MacDonell 1997). These ethnographic items, personal belongings of James H. Cook, and components of the former Cook Family Museum of Natural History comprise what is today known as the Cook Collection, housed and exhibited in the Agate Fossil Beds Visitors Center. Since resolving the "long series of proposals and negotiations between the Cook family, the State of Nebraska and

the federal government” (Bozell 2004:5) to create Agate Fossil Beds, the National Park Service has sought to develop and manage the land. The Cooks previously allowed widespread cattle grazing and artifact collections on the lands now contained within the monument borders. These activities are prohibited today under the Archeological Resource Protection Act (Evans-Hatch 2008; Wandsnider and MacDonell 1997).

Although the legislation creating Agate Fossil Beds focused on the paleontological resources and the Cook Family collection, it is clear that the park contains archaeological resources of interest as well. According to Evans-Hatch (2008:120-121), “certain inorganic and static landscape features in the vicinity of Agate Fossil Beds National Monument have had and still have cultural significance to Lakota Indians and are part of the Native American cultural landscape.” Evans-Hatch provides a list of such possible features, as well as two rock formations on the top of Carnegie Hill identified as altars. Carnegie Hill in particular, due to the prominent presence of prehistoric animals, is believed to have been a highly meaningful and spiritual place for the Lakota (LeBeau 2002). Furthermore, research completed by Wandsnider and MacDonell (1997) suggests that rich subsurface archaeological deposits may exist on the hilltops due to the predominance of artifacts present in rodent burrows. Contemporary Native American groups known to have formally utilized the land now in the vicinity of Agate Fossil Beds and must therefore be consulted with regards to research at the monument include: Lakota Sioux, Cheyenne, Pawnee, Ponca, Arapaho, and Plains Apache (Dismal River phase) (Bozell 2004; Clark 1993).

Archaeological Research History of Agate Fossil Beds

Jackson W. Moore completed the inaugural professional archaeological research at Agate Fossil Beds in 1966 with the goal of assessing a potential site for visitor/interpretive facilities (Bozell 2004; Nickel 2002). Moore also investigated an area containing debitage, stone tools, and tipi rings, but this area is now believed to have been outside monument boundaries (Bozell 2004). Moore did not document the location of any of his investigations at Agate Fossil Beds thus leaving subsequent researchers in the dark about his work. Adrienne Anderson (National Park Service; Anderson 1973) completed another brief reconnaissance survey in 1973 to assess the need and to recommend further inventories at Agate Fossil Beds to look for additional sites (Bozell 2004, Nickel 2002). Anderson and her crew identified and recorded 25SX152, a site located along the trail between the temporary visitors center and the quarries.

Marvin Kay and Steven Holen (University of Nebraska-Lincoln; Kay 1975) completed the first intensive archaeological survey in 1975. Kay and Holen noted that overgrown vegetation likely obscured many sites, but are believed to be the only crew to survey the *Stenomylus* Quarry unit (Bozell 2004). This crew recorded 11 sites including lithic scatters, rock cairns, and stone tipi rings (Nickel 2002).

In 1975, Danny Olinger (National Park Service; Olinger 1980) investigated subsurface deposits at 25SX163 – identified by Kay and Holen – because the construction of the interim visitor center threatened the site (Nickel 2002). The site previously yielded Dismal River phase ceramics but while Olinger and his crew recovered nearly 100 lithic fragments of interest, no further temporally identifiable artifacts were uncovered (Bozell 2004).

William Hunt, Jr. (National Park Service; Hunt 1990) visited Agate Fossil Beds in 1990 in order to evaluate an eroding feature near the Niobrara River identified by park staff. Hunt observed several artifacts, ash, and charcoal (Bozell 2004; Hunt 1990), as well as the similarity between the eroding stratigraphy and stratigraphy found at nearby 25SX163 by Olinger (Nickel 2002). Hunt initially recorded the area as 25SX89, but this site has subsequently been incorporated into 25SX163 after more investigation by Clark (Nickel 2002).

In 1991 and 1992, Caven Clark (National Park Service; Clark 1993, 1994) and a crew from the Midwest Archeological Center intensively investigated sites along River Road (aka Marsland Road) in anticipation of possible relocation of housing and maintenance facilities, as well as potential modifications to utility lines, and test excavated 25SX163 preceding the new visitors center, Clark's crew recorded thirty-six previously unidentified sites, as well as a previously unrecorded prehistoric lithic quarry. The National Register of Historic Places eligibility was also investigated for thirteen archaeological sites (Clark 1993).

In 1994 and 1995, LuAnn Wandsnider (University of Nebraska-Lincoln) and Vergil Noble (National Park Service) jointly directed both survey and subsurface investigations south of Niobrara River in Agate Fossil Beds. Thirty-two new sites were recorded as well as 116 isolated finds (Bozell 2004, Wandsnider and MacDonell 1997). This was the first investigation within Agate Fossil Beds to incorporate a landscape archaeology model or to make use of Geographic Information Systems technology (Bozell 2004). According to Wandsnider and MacDonell (1997), temporally diagnostic stone tools collected within the park boundaries indicated that mobile prehistoric peoples

visited the area from Archaic times to the historic period. However, the close proximity of multiple Paleoindian sites indicates that the Agate Fossil Beds area was likely used earlier than the Archaic, though perhaps not as intensively.

Archaeologists have not conducted any investigations at Agate Fossil Beds since Nickel's 1996 park-wide survey that focused on areas north of the Niobrara River.

Roberts (2002) visited the park in 2002 to complete site condition assessments of select sites noted for continuing erosional issues. Additional unrecorded sites at Agate Fossil Beds were mapped in 2004, but documentation on these sites is not yet available (Bozell 2004).

Expectations

Based on previous research at Agate Fossil Beds and the Nebraska High Plains, it is possible to make predictions for this analysis. The surrounding high plains provide several sources of raw material, elaborated upon in Chapter Four, for chipped stone tools, including tabular deposits of Upper Harrison Moss Agate contained within the monument boundaries. Due to the relatively poor quality of the Moss Agate, this study should find few chipped stone tools of this material that required a great deal of work prior to use. Also, in conjunction with the extremely local nature of this material, it can be expected that Moss Agate materials will not show a large amount of maintenance prior to discard. The local Moss Agate quarries are concentrated in the uplands of Agate Fossil Beds (Bozell 2004). As such, one perhaps expects to find more Moss Agate cores at the

upland sites rather than the lowland sites. However, the difference in elevation between the two settings may not be great enough to effect a large discrepancy in raw material usage.

In general, one expects that past inhabitants made formal chipped stone tools of the high quality materials found in surrounding areas. Chipped stone tools reduced from high quality materials should also show evidence of greater utilization and maintenance prior to discard (Blades 2003; Bleed 1986; Bousman 1993; Daniel 2001). Evidence from surrounding areas such as the Western Black Hills (Kornfeld 2003) and Eastern Wyoming (Frison 1991) suggest a long occupation of the region. This occupation should be evident in the stone tools collected from Agate Fossil Beds through the projectile point types present and extensive reduction on high quality materials. The presence of a perennial stream and multiple springs (Nickel 2002) suggests that sites should be concentrated in the lowlands—not only for access to this water source, but also to avoid the strong winds that can sweep the uplands.

Summary

In sum, the High Plains has a rich research history, but has largely focused on Paleoindian sites and the bison bone beds that dominated the large-game resource and mobility models. Agate Fossil Beds represents an area of high variance environmentally but, based upon diagnostic artifacts, represents a space frequently traversed (Evans-Hatch 2008). As research on the High Plains focuses on landscape archaeology and its related aspects of time and place, this study builds upon previous investigations to

examine whether individuals considered or made Agate Fossil Beds a place or it just remained a pathway between resource islands. The presence of a diversity of fauna and the mitigating effects of a perennial water supply during climatic fluxuations suggest that ecologically, Agate Fossil Beds was a desirable place that should have persisted in the minds of past peoples (Brunswick 2003).

CHAPTER 4 – MATERIALS AND METHODS

“Artifacts have inherent properties, but the archeologist selects particular properties for attention and assigns boundaries and significance to them; recorded attributes are analytical units, not truly raw data” [Knudson 1983:4].

Introduction

This chapter describes the chipped stone tools employed to examine issues of place at Agate Fossil Beds. This chapter also provides the analytical methodology used to examine these collections in an effort to better enable future comparison with similar studies. Finally, this chapter also provides some expectations regarding the outcome of the analysis based upon previous research.

Materials

This analysis focuses on chipped stone tools recovered largely through surface collections, but also through limited subsurface excavations. The chipped stone tools not included in this study were omitted due to difficulties regarding their curation status. This analysis also does not include chipped stone tools collected by the Cook family prior to the creation of Agate Fossil Beds owing to their lack of provenience. The lithic analysis delineated here focuses specifically on formal chipped stone tools. Scholars routinely define stone tools as lithic objects utilized by people, which display evidence of modification from either use or the creation of an intentional form (Andrefsky 2005; Odell 2004). Formal chipped stone tools refer to those objects that are created or

modified by the careful reduction through flaking processes versus groundstone tools are created through the intentional grinding of surfaces on materials not suitable for flaking. Utilized flakes are not included in this analysis due to the subjectivity of their macroscopic identification.

One of the most versatile formal tool types is the biface, able to serve as a core, as an intermediate stage in making projectile points, or as a tool (Kelly 1988). Some debate exists among North American archaeologists over whether to use “biface” as a generic term for a bifacially flaked object or to reserve the term for more point-shaped bifacially flaked objects (Odell et al. 1996). Because this study is concerned with usable edge length, “biface” is applied to all tools that are bifacially worked to form a consistent median line around the entirety of the object (Andrefsky 2005).

Unifaces are largely comprised of scrapers. Few other formal unifacial tool types exist (e.g., spokeshave or graver). Flintknappers produce unifacial tools through the intentional reduction and retouch on only one side of an object (Odell 2004). This creates a steep edge angle and flake scars reaching deeper onto the dorsal surface of the tool (Andrefsky 2009). Since it is more difficult to distinguish formal unifacial tools from expedient unifacial tools, this analysis includes unifacial tools that exhibit evidence of shaping, particularly dorsal flaking. This does not guarantee the exclusion of expedient tools but eliminates the most basic flake-as-temporary scraper from this category.

Following Andrefsky (2005), this analysis includes cores because they are objective pieces, often purposefully shaped in order to maximize the amount of useable edge. Formal cores are purposefully shaped to predictably flake (Johnson 1987) and

therefore more energy expensive than informal cores; this is similar to the differential energy expenditure on formal versus expedient tools. According to Andrefsky (2005), informal cores can also be expected to have been reduced from poor quality raw materials and formal cores will be of a higher quality raw material in order to use that raw material to its greatest advantage. However, if high quality raw material is abundantly available in a location, then both formal and informal cores may be found of it.

Methods

The goal of the methods presented here is to characterize individual tools in terms of their degree of exhausted potential use, in effect to understand its life history. A freshly manufactured biface has maximum use potential while a small broken scraper with dulled edge may be approaching the end of its use-life. In order to quantify this, a series of measurements were made on chipped stone formal tools in order to assess the level of tool exhaustion present. When raw material type for each tool is also considered, these measures enlighten the researcher on the length and intensity of use by past occupants at Agate Fossil Beds.

This analysis utilizes only macroscopic means, i.e., any analysis that can be conducted using a 10x or less strength hand lens to make determinations in the examination of stone tools (Andrefsky 2005). Microscopic analysis is not included because this thesis is not intended to be a functional analysis of the stone tools, and therefore patterns of use wear that indicate particular tasks, for example, are beyond the

scope of this work. Discrimination between subtle intentional retouching, grinding, and some use-wear is not available through macroscopic means (Andrefsky 2005).

Raw Materials

The raw material sources utilized in chipped stone tool production are frequently incorporated by archaeologists into research questions focusing on mobility and procurement strategies (e.g., Bamforth 1986; Bamforth and Becker 2000; Binford 1979; Close 2000; Jeske 1992; Kelly 1983). Past researchers examined whether higher quality raw materials may be utilized for formal tools that will be curated (including recycling), while lower quality materials may be used to create expedient or informal tools that will likely have a shorter use-life (Andrefsky 1994; Berman et al. 1999; Close 1996; Daniel 2001). In this study, the quality of raw material and its proximity to the study area is considered in the creation of persistent places. Therefore, determining the type of raw material being exploited for tools found at Agate Fossil Beds assists in understanding what areas were attractive to prehistoric peoples across temporal boundaries when considered in conjunction with the exotic/local nature of the materials.

Sourcing of raw material types for this analysis is general, with notation of where known sources are located in or near the study area. Geochemical sourcing techniques have the ability to connect chipped stone artifacts with specific outcrops or deposits, but at present these techniques are destructive, requiring between 3 and 5- gram samples of the artifact (Tykot 2003). Instead, macroscopic means of associating artifacts with raw material types are employed, such as descriptions of color, luster, inclusions, texture, or other easily notable qualities (Tykot 2003).

Raw material occurs in surface concentrations, stream deposits, quarries, and mines (Odell 2004). A variety of raw material types are available near or within Agate Fossil Beds. Upper Harrison Formation Moss Agate outcrops within the boundaries of the Agate Fossil Beds. The Niobrara River and other regional water sources (e.g., the White River to the north) provide flakable glacial cobbles. Multiple types of material are also found to the west, in the present day state of Wyoming, within a reasonable traveling distance (Table 4.1). However, the quality of these materials is not equal and this must be considered in a distributional analysis chipped stone tools.

Table 4.1. Nearest Quarries of Raw Material Types

Material Type	Nearest Quarry	Source
Blackhorse Creek Chert	60 km/ 36 mi, NE	Clark 1994, Wandsnider and MacDonell 1997
Flattop Chert	90 km/ 55 mi, WY	Wandsnider and MacDonell 1997
Hartville Uplift Chert	50 km/30 mi, WY	Wandsnider and MacDonell 1997
Kimball Chert	90 km/ 55 mi, WY	Wandsnider and MacDonell 1997
Limestone	0 km/0 mi, NE	Wandsnider and MacDonell 1997
Plate Chalcedony	Sioux County, NE	Clark 1993, 1994
Quartzite	Indeterminate	Clark 1993, 1994
Cloverly Quartzite	50 km/30 mi, WY	Wandsnider and MacDonell 1997
Table Mountain Chert	90 km/ 55 mi, WY	Wandsnider and MacDonell 1997
Upper Harrison Formation Moss Agate	0 km/0 mi, NE	Bozell 2004

Core Analysis

This analysis evaluates core attributes related to the size of the core and the raw material from which it is made. Techniques of core measurement are rarely included in lithic analyses and there has been little consistency between analyses (Andrefsky 2005; Odell 2004). However, core reduction is directly related to the size of the original raw material piece because the discarded core cannot be larger than the original cobble, and cobble size has a direct effect on the type of technology that is applied to core (Andrefsky 2005). Because maximum length and width are subject to vague concepts of orientation with regard to the core (particularly on multidirectional cores), Andrefsky (2005) recommends classifying core size as weight and maximum linear dimension. In this analysis, weight and maximum linear dimension is recorded for all cores.

Chipped Stone Tool Measurements

Biface measurements include maximum length, width, and thickness, percent cortex, weight, edge angle, and the length and interior thickness of usable edge. Length, width, and thickness are measured using standard calipers. A contact goniometer is used to measure maximum edge angle as an indicator of use-wear. Multiple measurements are taken along the usable edge and averaged to find a mean edge angle (Ahler 1971). Length of usable edge is measured by rolling the bifacial edge in polymer-based modeling clay, and used to create a percentage based on the ratio of utilized edge length to total usable edge length. Any remaining cortex is identified and measured (see below). For this analysis, chipped stone tools that are not projectile points are measured in the

same manner as bifaces. Tool type designations are intended to be descriptive descriptions rather than functional explanations due to the effect of reduction on the apparent morphological classification of an item (Nejman and Clarkson 2008).

This study includes all projectile points as bifaces. The exception is when projectile points are stylistically identifiable to an archaeological time period. Not all projectile points can be assigned to established types due to the slow gradation and overlap of stylistic change (Whittaker 1994:263). However, projectile points have a long history in American archaeology as index fossils, used to date contextually associated materials due to their distinctive and rapid modification through time (Whittaker 1994). This thesis includes an examination of persistence of place across temporal boundaries. In order to do so, projectile point types are used as temporal markers to indicate the reoccupation of the landscape. Similarly, this analysis uses a generic “uniface” category to incorporate tools with unifacial edges such as scrapers.

Employable Units

A focus of the chipped stone tool analysis applied to bifaces and unifaces in this thesis is the employable unit or EU. Knudson (1983) first used the employable unit as a way to functionally look at chipped stone tools and flakes without specifying stylistic differences. This form of analysis focuses on the specific edges utilized, recognizing that the utilization of chipped stone materials focused on the utilization edges – and in some cases, the projections—and not the overall shape and morphology of the object. Knudson (1983) utilized EUs to differentiate between Plainview and MacHaffie paleo-projectile

points based on the position of EU types on the items. EUs have also been utilized by Kornfeld and colleagues (1990) to examine the invasiveness and shape of marginal retouch on artifacts from an Archaic scraper cache from the McKean site. Similarly, Kornfeld (2009) also utilizes EUs to examine bifaces from the Hell Gap site to compare retouch and use toward an understanding of biface edge shape.

What is an EU? Knudson (1983:10) defines it as “that segment or portion (continuous edge or projection) deemed appropriate for use in performing a specific task, e.g., cutting, scraping, perforating, drilling, chopping. The unit is identified by deliberate retouch and/or apparent post-production utilization modification, and its boundaries are defined subject to the analyst’s own concept of ‘habitual use’.” In this analysis, EUs indicate utilized edges that, in a ratio to overall edge length, inform on the extent of use prior to discard. The higher percentage of utilized edge on the object, the more the object was utilized prior to discard. However, this is only quantitative data and is not intended to explain *why* the artifact’s past owner chose to discard the tool at Agate Fossil Beds. The answer to *why* is likely the result of multiple and intertwined influences (Knudson 1983).

Cortex

If cortex is present on any chipped stone tool, percentage of cortex is measured using the dot grid method described by Andrefsky (2005:106-107). This method is simple and descriptive. A cortex ratio of cortical surface: total surface is obtained in an effort to examine reduction and transportation strategies. Douglass and colleagues (2008)

employed this strategy in New South Wales, Australia to answer the question of where initial lithic processing (i.e., removing the cortical surface) occurred in relation to debitage discard. The palimpsestic depositional situation encountered in New South Wales is similar to that of Agate Fossil Beds, though much more extreme. This research examines cortex ratios to consider patterning within and between the site clusters. Patterns will then be compared with proximity of utilized raw material sources.

Summary

Many debates exist regarding the most advantageous methods of analysis and one maxim is apparent; consistency and clear delineation of methods are crucial. Thus this chapter defines the specific measurements and analysis techniques that are applied in this thesis, not only in the interest of transparency, but also to establish consistent guidelines. This is particularly important on the Plains, where a dearth of reference materials can make inter-site comparison difficult.

The distinctive nature of North American projectile points and other tools provides a common language for archaeologists to look at occupation beyond the site level to the landscape. Through an examination of edge utilization on formal chipped stone tools, this analysis aims to establish the intensity of occupation at Agate Fossil Beds. With this information, this thesis can address issues of place.

CHAPTER 5 – RESULTS AND DISCUSSION

Introduction

The previous chapter described the materials and methods utilized in this analysis to look at the development of place on the Nebraska High Plains, specifically at Agate Fossil Beds. Previous archaeological investigations and the constructed culture-history of Agate Fossil Beds suggest that this may have been merely a crossroads location due the lack of large habitation sites or butchering areas (Evans-Hatch 2008). This chapter presents the results and discussion of this attempt to examine through chipped stone tool analysis whether Agate Fossil Beds was just a crossroads between other locales. How important was the local Upper Harrison Formation Moss Agate (hereafter referred to as Moss Agate)? Were the chipped stone tools deposited, intentionally or unintentionally, here used extensively prior to discard or used briefly and tossed aside? These and other questions may provide a more complete picture of past activities at Agate Fossil Beds.

Summary of Data

This analysis incorporates 27 cores and 79 chipped stone tools sorted from among 6,068 total artifacts collected from nineteen sites—14 lowland sites located closer to the river and five upland sites rising above the flood plain (Table 5.1). The chipped stone tools include 59 bifaces, 17 unifaces, and three tools that fit neither the biface nor uniface category. Among the materials are four collected by either monument staff or monument

Table 5.1 Chipped Stone Materials Included in this Analysis.

Site Location	Site	Bifaces	Unifaces	Cores	Other
Lowland	25SX152	5	1	1	
Lowland	25SX153	1			
Upland	25SX156	3			
Lowland	25SX157	20	8	11	
Lowland	25SX160	1			
Lowland	25SX163	22	5	8	1
Lowland	25SX191		1		
Upland	25SX193			1	
Lowland	25SX253	1			
Lowland	25SX268			1	
Lowland	25SX469	2			
Lowland	25SX471		1		1
Lowland	25SX474	1			
Lowland	25SX479	1			
Lowland	25SX481	1	1		
Upland	25SX489			1	
Upland	25SX491			1	
Upland	25SX498	1			
Lowland	25SX499	1			

visitors that cannot be attributed to a particular site but are known to come from within the boundaries of Agate Fossil Beds. Projectile point styles present indicate that people utilized the landscape of Agate Fossil Beds from Paleoindian times through Late Prehistoric (Bozell 2004).

Archaeological sites have been documented throughout Agate Fossil Beds and on both sides of the Niobrara River. Sites are in particular abundance along the Marsland Road (also known as the River Road) due to a sampling bias associated with building improvements at the monument (Clark 1994). This is likely reflected in the artifact distribution between the lowlands and the uplands. The majority (n=96) of chipped stone

tools and cores in this analysis were recovered from 14 lowland sites (Table 5.1). For the most part, upland sites consist mainly of lithic scatters that were recorded by investigators who did not collect artifacts during the project. This study includes artifacts taken from upland sites where available, but unfortunately a quantitative upland versus lowland distribution analysis cannot be completed at this time.

Subsurface investigations of archaeological deposits were completed at seven sites: 25SX152, 25SX157, 25SX163, 25SX253, 25SX268, 25SX471, and 25SX481. In Table 5.1, the frequency of artifacts listed for the sites above include both artifacts recovered from excavations and surface contexts. Archaeologists recovered the majority of chipped stone tools (68.4 percent) and cores (64.3 percent) from surface collections. However, this is also likely the result of sampling bias as past archaeological investigations at Agate Fossil Beds focused on or included pedestrian survey and surface collection (Bozell 2004). According to Clark (1993, 1994), among the highest-elevation sites with below surface testing, many of the test units revealed no cultural deposits. This suggests that soil deflation during the 1930s (Kornfeld and Larson 2009) may mean that wind-exposed areas consist only of surface deposits.

Raw Material

Table 5.2 summarizes raw material types for all unifaces, bifaces, cores, and other items. Over 36 percent of the materials analyzed for this study are reduced from Hartville Uplift chert and it is the most common raw material collected from lowland sites (Table 5.3). Moss Agate comprises approximately 24 percent of the analyzed

materials and, by frequency, is the most commonly collected material type from upland sites.

Table 5.2 Raw Material Types by Tool Type

Raw Material Type	Bifaces	Unifaces	Cores	Other
Blackhorse Creek Chert	1	1		
Flattop Butte Chert	3	1		
Hartville Uplift Chert	17	9	11	2
Kimball Chert	4			
Table Mountain Chert	10	8	1	
Limestone	1			
Plate Chalcedony	2			
Moss Agate	10	2	13	
Quartz	2			
Cloverly Quartzite	8		1	
Quartzite	2			
Unknown	4	2		1

Table 5.3. Tools and Cores Distributed by Lowland or Upland Context and Material Type

Raw Material Type	Lowland Sites	Upland Sites
Blackhorse Creek	2	
Flattop Butte	3	
Hartville Uplift Chert	39	
Kimball Chert	2	1
Limestone	1	
Moss Agate	19	5
Plate Chalcedony	2	
Quartz	2	
Quartzite	2	
Cloverly Quartzite	9	
Table Mountain	8	1
Unknown	6	

Cortex

Table 5.4 presents data on the presence of cortex on cores. Among the cores analyzed, Moss Agate contained more cortex than Hartville Uplift chert or Table Mountain chert; no other lithic material present contained cortex. Furthermore, Moss Agate also demonstrates a higher amount of cortical surface coverage. This may be due to the tabular nature of the deposits and/or the extremely close proximity of recovered artifacts to the quarries, i.e., within the monument boundaries. Overall, nearly 63 percent of the cores do not have any remaining cortex.

Analysis indicates a low level of cortex present on the chipped stone tools. Only two chipped stone tools—one biface and one uniface—display cortex. The quartz biface remains 75 percent covered (110 mm) and the Hartville Uplift uniface is 25 percent covered (6 mm). In comparison with the cortex on the cores, it appears that the low number of tools displaying cortex (39.5 percent) is likely due to the low use of Moss Agate for formal tools.

Table 5.4. Cores with Cortex Attached.

Material	Total Cores	Cores w/Cortex	Total Cortex Area (mm²)	Avg. % Cortex
Moss Agate	13	5	437	40
Hartville Uplift Chert	11	4	204	25
Table Mountain Chert	1	1	18	25

Employable Units

Bifaces, unifaces, and other formal tools were analyzed in terms of employable units (EUs), edges or projections available for utilization. This also allows for the analysis of multifunctional tools that contain both unifacial and bifacial edges irrespective of the form of the item. Two to three EUs per chipped stone tool occurs most frequently on both bifaces (mean = 2.42) and unifaces (mean = 2.64; Figures 5.1, 5.2); however, bifaces have a greater range of EU frequency and the frequency is more evenly distributed.

The bifaces with higher numbers of EUs ($n > 3$) are from 25SX152, 25SX157, and 25SX163, all of which are lowland sites near the river. The unifaces demonstrate the same pattern: artifacts with the highest numbers ($n > 3$) of EUs were collected from lowland sites, i.e., 25SX152, 25SX163, and 25SX481.

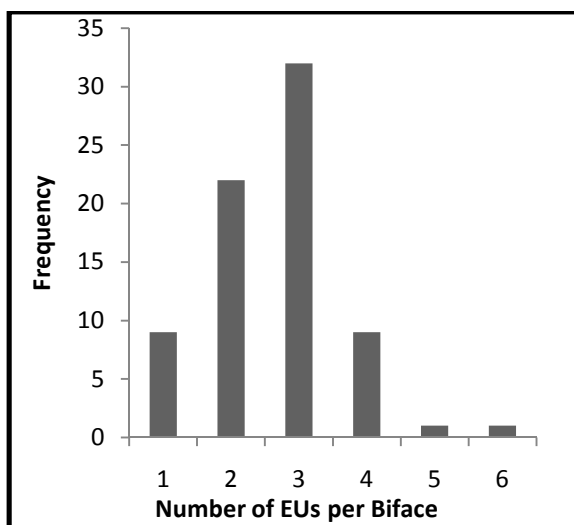


Figure 5.1. Frequency of EUs on Bifaces

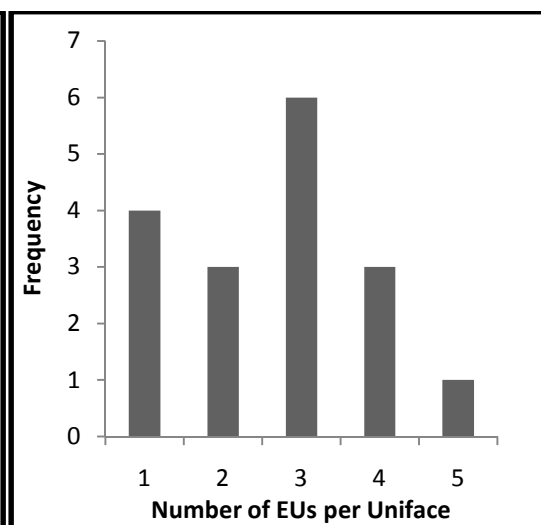


Figure 5.2. Frequency of EUs on Unifaces

The average frequency of EUs on bifaces by raw material type (range = 2 to 3 EUs) mirrors the average number of EUs on bifaces in general (Table 5.5). On bifaces, individual EUs make up approximately 31.18 percent of the total edge length of the object and the combined individual EU lengths of an object total 45.77 percent of the total potential edge length. Utilized edges on bifaces measured a mean depth of 1.42 mm (median = 1.35 mm) and ranged from minimal edge evidence (0.26 mm) to a depth of 8.54 mm on a medial biface fragment of Hartville Uplift that appeared to be extensively utilized. The mean thickness of bifaces at the interior edge of the use-wear is 1.69 mm. The analyzed EUs average an edge angle of 60.54° (range = 42° to 84°, median = 60°).

This analysis completed identical calculations for EUs identified on the 17 unifacial tools as well. Unifacial tools display a slightly larger range of EU frequency distributed between raw materials, between one and four (Table 5.5). However, this still reflects the general mean number of EUs per unifacial tool (mean = 2.64 EUs). The results are also consistent with Kornfeld and colleagues' (1990) findings at the McKean

Table 5.5. Average Number of EUs on Tools as Distributed by Material Type

Raw Material Type	Bifaces	Unifaces
Blackhorse Creek Chert		2
Flattop Chert	3	3
Hartville Uplift Chert	2.71	2.56
Kimball Chert	2.67	
Table Mountain Chert	2.5	4
Plate Chalcedony	2	
Moss Agate	2.45	1
Quartz	2.5	
Cloverly Quartzite	2.63	
Quartzite	2.63	2.5
Unknown Material	3.25	3.5

Site. At the McKean Site, endscrapers contained between zero and four EUs per tool, with a mean of two EUs per endscraper. On unifaces from Agate Fossil Beds, total utilized edges on an individual object comprise the majority (mean = 95.51 percent) of total potential edge length for that object. Individual EUs average 36.08 percent of the total potential edge length. The mean depth of edge use on analyzed unifaces is 2.01 mm (range = 0.63 to 6.33 mm). The mean thickness of the unifaces at the interior periphery of macroscopic use-wear evidence is 2.25 mm (range = 1.01 to 5.95 mm). Mean edge angle of the EUs measured on unifaces is 72.84° with a range between 47° and 90° (median = 74°). This range of edge angle is wider than the range presented by Kornfeld and colleagues (1990) on materials from the McKean Site toolkit. At the McKean Site, edge angles on endscraper EUs range between 62° and 70°.

The category “other” was applied to three chipped stone tools that neither fit into the biface or uniface category neatly. Two of the other objects appear bifacially worked, perhaps reworked projectile points, but the edges display unifacial utilization. The third object appears to be a burin-style tool (projection EU). An average of 2.67 EUs per object, the non-biface and non-uniface items consist of Hartville Uplift (n=2) and unknown material (n=1; Table 5.2). The 83.51 percent of the total potential edge length of these items consists of utilized edge. Individually, each EU averages 31.82 percent of the total potential edge length of the object. The mean depth of edge utilization is 1.28 mm (range = 1.26 to 2.35 mm, median = 1.50 mm). The thickness of the object at the interior termination of edge use averages 1.53 mm (range = 1.34 to 2.59, median = 1.84

mm). The mean edge angle of EUs on these object is 68.13° and ranges between 59° and 80° (median = 67°).

Cores

Archaeologists collected 27 cores from Agate Fossil Beds included for analysis in this study (Table 5.6). The largest number of cores consists of Moss Agate, the most local lithic resource. However, in terms of total weight, Hartville Uplift comprises more total grams of material than Moss Agate. Two other raw material types (Cloverly Quartzite and Table Mountain chert) present weigh only 2.12 percent of the total weight. Pearson's Chi-Square indicates that the frequency of Hartville Uplift cores at lowland sites is statistically significant ($\chi^2 = 5.344$; $df = 1$; $p = .021$). See above for cortex information with regards to cores. As Table 5.6 indicates, Moss Agate cores are smaller than Hartville Uplift chert cores in both mean weight and volume. Furthermore, Moss Agate cores have a smaller range of weight and volume than Hartville Uplift chert. This may be due to the type of deposits from where the material is acquired.

Table 5.6. Cores Included in this Study

Raw Material	Cores	Total Weight (g)	Mean Weight (g)	Weight Range (g)	Mean Volume (mm ³)	Volume Range (mm ³)
Hartville Uplift Chert	11	1633.27	148.48	10.4-514.2	151,033.8g	9451.57-552,000.1
Moss Agate	13	964.41	74.19	17.49-249.41	69,264.19g	17,812.01-227,350
Cloverly Quartzite	1	22.36	-	-	13,420.12g	-
Table Mountain Chert	2	33.91	16.96	5.8-28.11	17,939.92g	7178.97-28,700.87

Only one core is noted as completely spent (Hartville Uplift chert, 25SX268).

The majority of cores (n=26, 96%) appear complete with no obvious terminations suggesting that the core is a fragment. One Hartville Uplift chert core from 25SX163 is semiprismatic, suggesting that blades were struck off this area. This core maintained a viable striking platform for this area.

Results and Discussion

The data provided above indicate that there is not a great deal of variation between bifaces and unifaces once one considers the edges individually. The exception, as might be expected, is the edge angle, which illustrates the fundamental difference between unifaces and bifaces in how edges are used (Andrefsky 2005). The mean edge angle for bifaces is 60.54° and 72.84° for unifaces. The closer an edge angle becomes to 90° , the less usable the edge becomes for cutting or slicing (bifacial purposes), perhaps indicating higher degree of use prior to discard for bifaces. Even on unifacially-worked edges, as the edge angle approaches 90° the edge becomes less useful for scraping (Andrefsky 2009). The range of edge angle measured on both bifaces and unifaces display a range of values that alone do not suggest a particular degree of use prior to discard.

The percentage of edge use, calculated from the total utilized edge: total potential edge length ratio, indicates that unifaces display a higher degree of utilization. On unifacial tools, past peoples utilized 95.51 percent of the total potential edge. The

bifacially worked, unifacially utilized objects demonstrate a similar frequency at 83.51 percent. The edges of bifacial tools are 45.77 percent utilized, approximately half the usage displayed by unifaces. However, a large portion of the bifaces (45 of 59 bifaces) collected at Agate Fossil Beds are in fragmentary form – perhaps skewing the data, while unifaces are largely complete.

When plotted (Figure 5.3), bifaces made from materials available approximately 50 km or less from Agate Fossil Beds show the highest percentage of potential edge utilization. This includes Hartville Uplift Chert and Moss Agate, which comprise two of the most common biface materials (Table 5.2). However, as shown by Figure 5.4, Hartville Uplift Chert and Moss Agate also show the greatest range of utilization, whereas Plate Chalcedony, quartz, and Cloverly Quartzite are relatively clustered near the 100 percent utilized mark. Interestingly, artifacts produced from the most exotic represented materials are not as utilized. Perhaps this is influenced by the quality of the material?

Figure 5.5 plots the percent of total potential edge utilized against the distance of the nearest quarry for unifaces. Materials from approximately 90 km distant are represented more among the unifaces than the bifaces. Artifacts produced from raw materials 50 km distant have a greater range of utilization, perhaps as expected of local high quality materials.

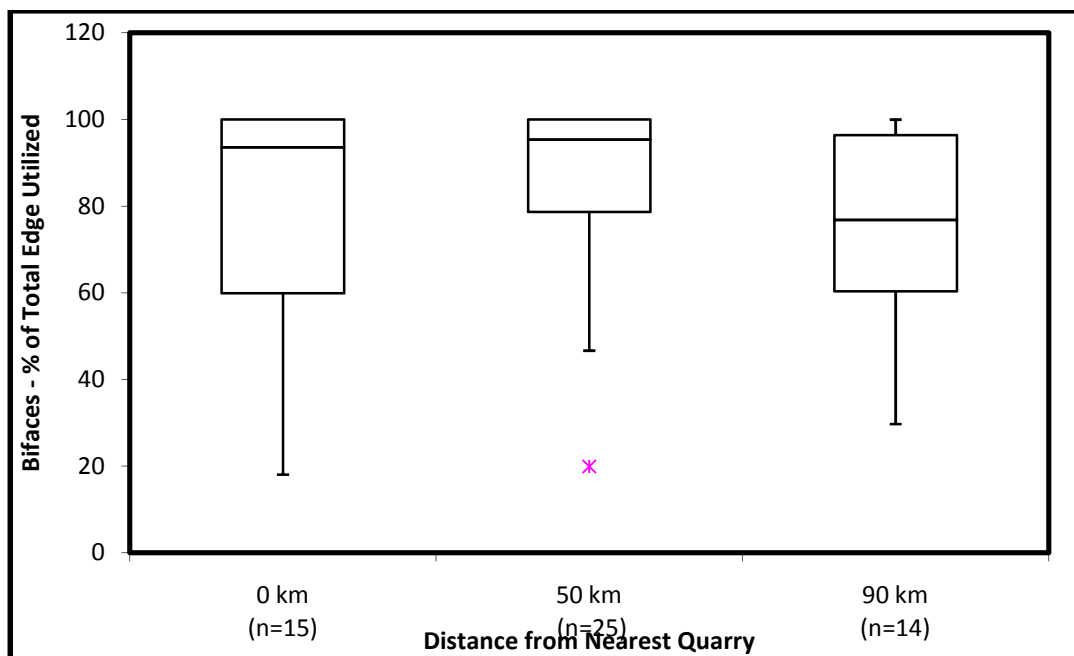


Figure 5.3. Percent Utilized of Bifaces' Total Edge by Relative Localness of Raw Material

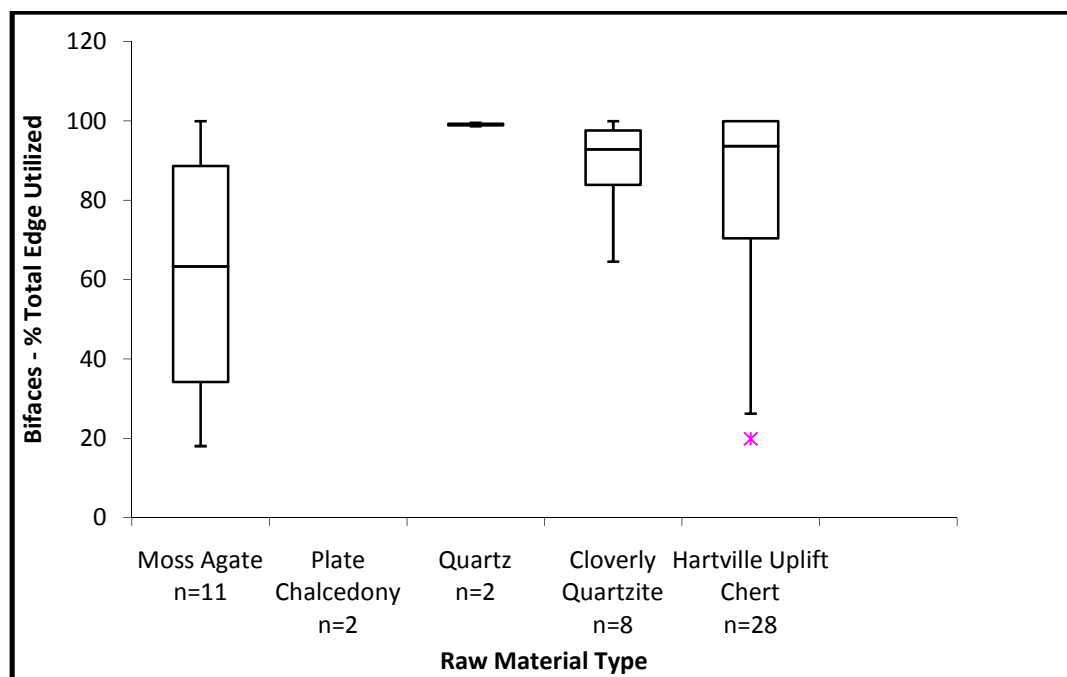


Figure 5.4. Percent Utilized of Bifaces Total Edge by Raw Material

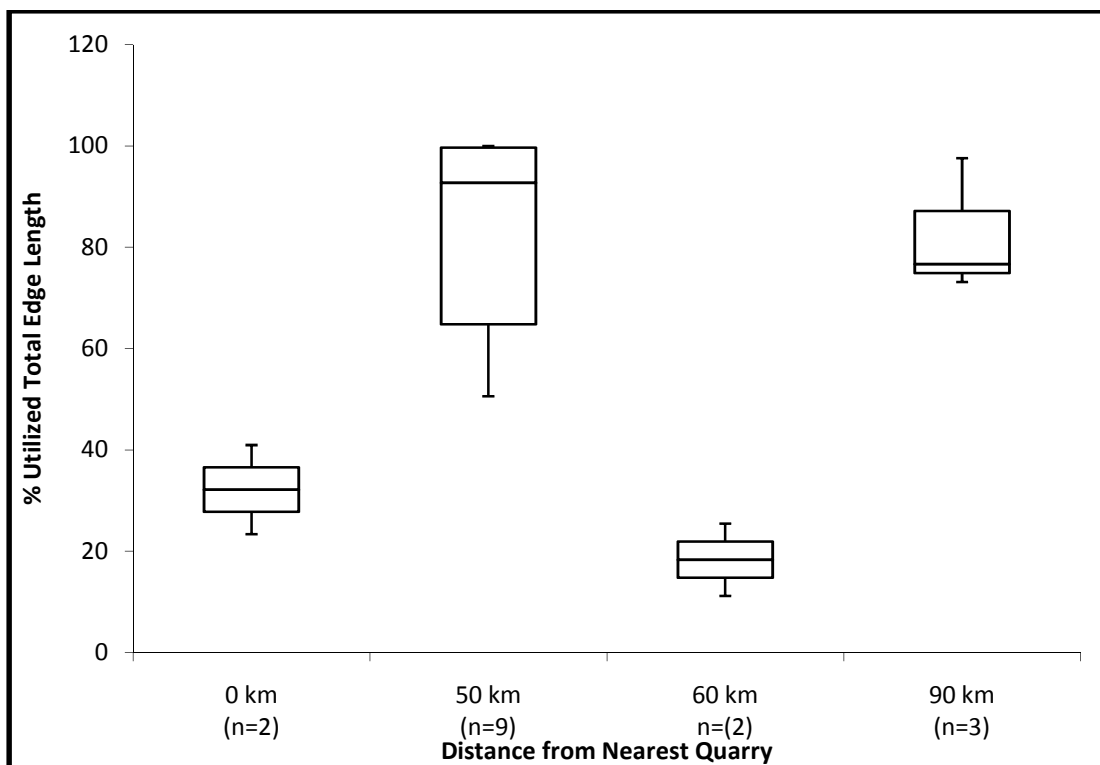


Figure 5.5. Percent Utilized of Unifaces' Total Edge by Relative Localness of Raw Material

One way to determine the degree of utilization prior to discard on a biface is to examine how much of the total edge is utilized compared to the mean edge angle for the biface. Figure 5.6 suggests that few bifaces present at Agate Fossil Beds were completely utilized in both dimensions prior to discard. Over a third of the bifaces have steep edge angles as well as high percentage of utilized length, and the majority of these bifaces are produced from Hartville Uplift chert (Figure 5.7). However, this analysis indicates that many of the materials with a high percentage of used edge length still have utilizable edge angles. A comparable analysis of another assemblage is necessary in order to determine at what point this proportion becomes significant. The data presented here suggest that Hartville Uplift chert bifaces were not only being widely utilized, but

that they were reaching the end of their tool-life history in this area, based on the edges available for analysis. This may also be supported by the high percentage of bifaces that are fragmented (76.27 percent).

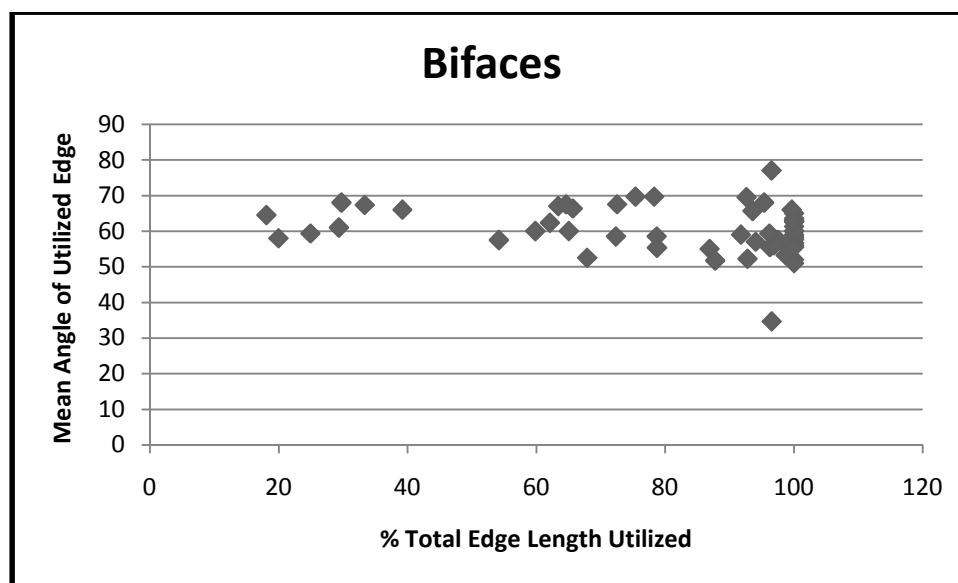


Figure 5.6. Comparison of Mean Edge Angle to Percent Total Edge Utilized for Bifaces.

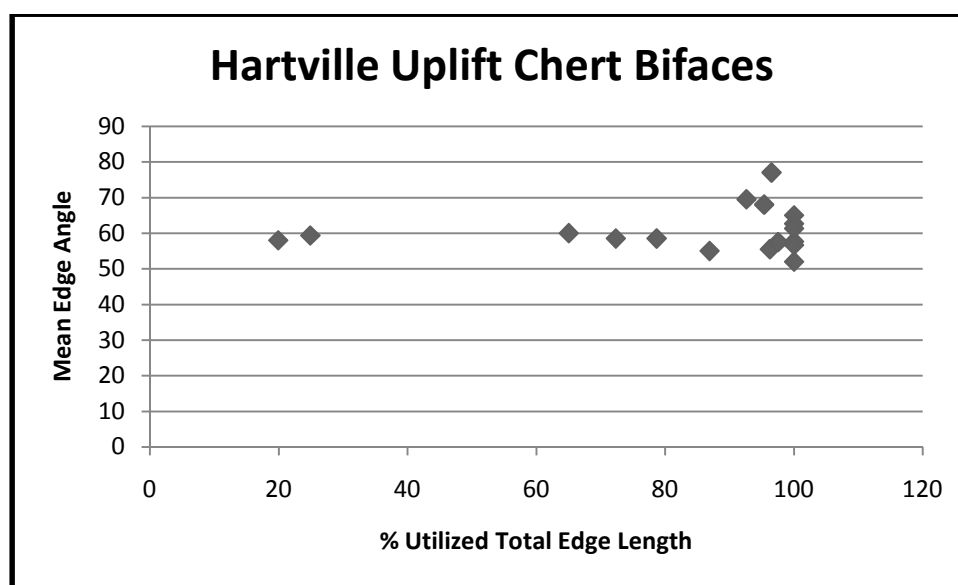


Figure 5.7. Comparison of Mean Edge Angle to Percent Total Edge Utilized for Hartville Uplift Chert Bifaces.

Unifaces require a different method of measuring tool-life history. Hiscock and Attenbrow (2003) have developed an index for unifacial edges based on the ratio of retouched edge to total tool edge and the degree of concavity or convexness at the utilized edge. The latter portion of the index is based on the principle that retouch intensity will result in a more rounded edge. This study includes a modification of this index to chart degree of utilization on unifaces. The utilized percentage of total potential edge is plotted against the mean depth of the utilized edge. As the edges of a uniface become more rounded (i.e., Hiscock and Attenbrow's index), the scarring on the face of the tool should move deeper onto the face.

Figure 5.8 indicates that while some unifaces display scarring deep onto the face of the artifact, the total potential edge utilization is low for those artifacts. Unifaces with high percentages of utilized edge do not show deep retouch. This appears to indicate that unifaces are not near the end of their tool-use life when being discarded at Agate Fossil Beds. Andrefsky (2009) states that raw material proximity can influence whether tools are curated, and that different raw materials are preferred for particular tool types. Therefore, with the abundance of Moss Agate at Agate Fossil Beds, it may not have been necessary to curate unifacial tools if individuals were aware of its presence.

Cores at Agate Fossil Beds do not appear to contribute much to discussions of place. The poor quality of the local Moss Agate is demonstrated in the small sizes of Moss Agate cores. The distribution of Moss Agate cores focused at lowland sites suggests that individuals carried the cores away from the quarries on the narrow ridges to the larger sites for working. There is no indication that the majority of cores are spent,

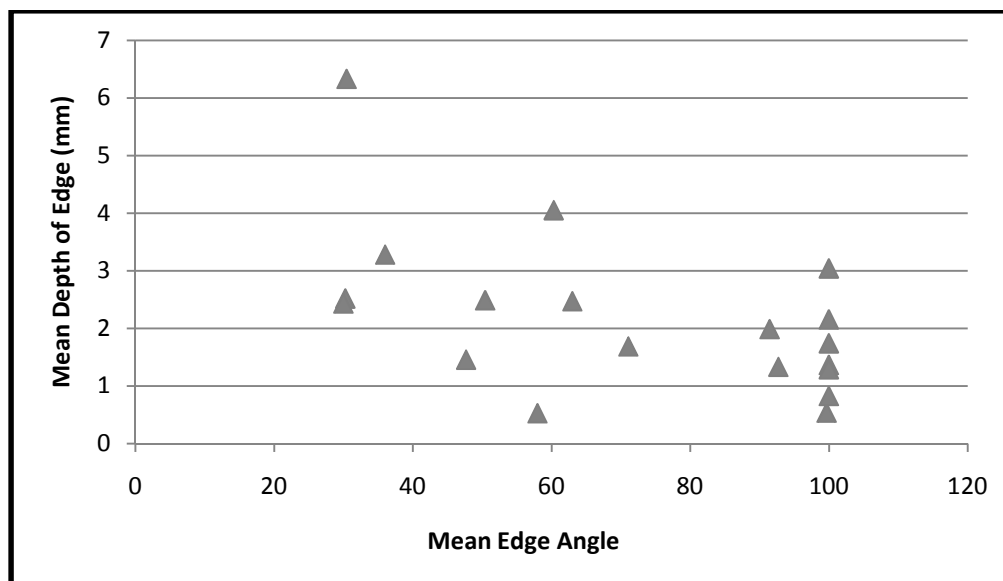


Figure 5.8. Comparison of the Mean Depth of the Utilized Edge to the Mean Edge Angle for Unifaces

although cortex is concentrated on Moss Agate. Several cores are quite small which is consistent with expectations. As previously stated in this chapter, the majority of cores consist of Moss Agate, which is also consistent with expectations that the most local raw material would be most prominently represented among cores. Archaeologists also collected cores through surface investigations in isolation from formal stone tools. A study of the lithic debitage collected from Agate Fossil Beds would be necessary to complete the interpretation of lithic distribution, particularly with regards to core distribution as an indicator of stone tool production areas.

Time

This chipped stone tool analysis confirmed previous assessments that although evidence suggests occupations of Agate Fossil Beds were transient, occupations

Table 5.7. Diagnostic Artifacts Included in this Study

Site	Setting	Projectile Point Identification	Source	Material	Portion
25SX152	Lowland	Paleoindian - Scottsbluff (Cody/Eden)	Wandsnider and MacDonell 1997	Unknown	Medial
25SX163	Lowland	Late Prehistoric - Plains Side-notched	Olinger 1980	Cloverly Quartzite	Distal
25SX163	Lowland	Paleoindian - Clovis	Based on Justice 1987	Quartzite	Proximal
25SX469	Lowland	Late Paleo/Early Archaic - Pelican Lake?	Clark 1993	Hartville Uplift Chert	Distal
25SX479	Lowland	Late Prehistoric - Plains Side-notched	Clark 1993	Kimball Chert	Distal
25SX481	Lowland	Archaic - Logan Creek	Clark 1993	Flattop Chert	Distal
25SX498	Lowland	Archaic - McKean?	Clark 1993	Kimball Chert	Distal

reoccurred repeatedly through time, even through multiple changes in the local climate that occurred on the High Plains (Wandsnider 1999). Projectile points serve as fossil indicators of repeated visits from Paleoindian through Historic times (Table 5.8). Sixteen projectile points could not be stylistically associated with a particular time period. While two natural resources, the Niobrara River and local deposits of Moss Agate, likely contributed to the area's attractiveness, the relatively poor quality of these resources in comparison with other local resources suggests that the repeated occupation of the landscape cannot be attributed wholly to these factors.

Summary

This chapter presents the data collected according to the analytic methods set out in chapter four. The results and discussion section provides both a graphic and textual interpretation of the data and what it can contribute to an examination of place at Agate Fossil Beds. Analysis of cores has contributed little to the discussion other than the

perhaps surprising result that Hartville Uplift cores represent a larger sample by both weight and volume than the local Moss Agate. Bifaces, especially Hartville Uplift bifaces, demonstrate high levels of curation prior to discard, but unifaces, particularly those of Moss Agate, appear to retain a high potential for continued use at the time of discard.

CHAPTER 6 - CONCLUSION

Introduction

This thesis seeks to examine whether or not Agate Fossil Beds became a place(s) to prehistoric people on the Nebraska High Plains through the analysis of chipped stone tools. This chapter provides a summary of the results of this examination and a discussion of how this research fits into larger issues. Finally, this chapter provides avenues of future research to further the preliminary analysis presented here.

Summary: Is this a place?

As established in chapter two, landscape archaeology focuses on the interaction between individuals and the land on which they live, as well as how they conceptualize the land (Clark and Scheiber 2008). Clark (2008) advocates expanding the focus of archaeological investigations beyond excavation to the distribution of nearby sites and isolated artifacts or features (also Scheiber 2008:19). Individuals do not necessarily return to a place for only practical reasons, but also for social or ritual reasons that may not leave a signature on the landscape regularly sought by archaeologists (Clark and Scheiber 2008). According to Mitchell (2008:47), “the potential of a place can therefore be defined in terms of technologies, the relations of production, and cultural values.” This chipped stone tool analysis addresses just one portion of Agate Fossil Beds’ potential as a place. The search for and extraction of resources is a cultural act, even though the resource is potentially a natural occurrence (Mitchell 2008). Therefore, is an

examination of chipped stone tools and cores an effective way to examine place at Agate Fossil Beds National Monument?

All identifiable raw materials represented by the chipped stone tools and cores included in this analysis are relatively locally available when the lack of geographic obstructions is considered. In particular, the two most common materials utilized are also the most geographically available. Moss Agate is quarried within the monument boundaries. Hartville Uplift Chert is available near Lusk, Wyoming at the head of the Niobrara River less than 100 km west of Agate Fossil Beds (Bozell 2004; Reher 1991). Due to the high availability of good quality, local lithic sources, it is unlikely that chipped stone tools collected at Agate Fossil Beds are the result of recycling by multiple generations, as is common in lithic-poor areas (Camilli and Ebert 1992). The quantitative evidence suggests variability in the degree of use prior to discard and the intensity of occupation at Agate Fossil Beds remains poorly understood. Approximately one-third of bifaces appear to be approaching the end of their use-lives, but without a comparable assemblage to establish a baseline, it is difficult to say whether this is significant. Unifaces were discarded with apparently more potential use than bifaces, perhaps due to the local availability of suitable material to create new unifaces.

Evans-Hatch (2008) suggests that due to the lack of large butchering sites and occupation evidence, Agate Fossil Beds served as a crossroad between other places. However, this falls into a common descriptive pattern among archaeologists that while large, substantial sites are considered in terms of features and artifacts present at the site(s), small, highly mobile occupations are often described in terms of what is not

present (Gilmore 2008; Kornfeld 2003; Mitchell 2008; Scheiber 2008). But as Johnson (2008:121) argues, “[p]eople traverse the area, and use of the landscape as a whole can be attested to through the distribution of persistent places, stopping points, and isolated finds.” In Chapter Three, this study hypothesizes that a high degree of utilization prior to discard correlates with a place where individuals were staying long enough to use up their individual tools, rather than just passing through to another location. Unfortunately, the results are too preliminary at this stage to adequately address this hypothesis.

Landscape archaeology has the ability to focus on the “multilayered connection” (Scheiber 2008:25) individuals have with a place, and therefore examine place for the ephemeral evidence not demonstrated by small occupations. As Mitchell (2008:60) states, “significant places cannot be defined solely in terms of abstract distribution of natural resources,” because it does not include the ceremonial assemblies that draw individuals together to create meaningful bonds within and without groups. Unfortunately, it is the social and sacred landscape aspects that leave ephemeral evidence. Chipped stone tool analysis utilizes a natural resource that has been culturally modified in order to address a layer of place and is effective, even with the lack of conclusive evidence, in contributing to ways archaeologists can move beyond simple distributional and form/function analyses. But chipped stone tools cannot address the other layers of a place.

A Traditional Cultural Property Inventory (TCPI) attempted to address the elusive aspects of sacred/social landscape at Agate Fossil Beds. LeBeau (2002) designated fourteen sites on the TCPI including rock cairns and depressions. However, some of the

designations are currently disputed by other members of the Cheyenne River Sioux (Lakota) tribe (Albert M. LeBeau, III personal communication, 2010). Sundstrom (2003) demonstrated the effectiveness of ethnographic techniques to investigate these aspects, but the LeBeau's disputed designations suggest that this area remains problematic for the archaeological landscape of Agate Fossil Beds.

Use of Past Collections

As archaeological techniques evolve, the need arises for archaeologists to reevaluate artifact assemblages from past investigations. Bamforth (2002) demonstrates this need for reinterpretation of past assemblages with his work on materials from the now-destroyed Allen Site in southern Nebraska (see also Bamforth and Becker 2000; Bamforth et. al 2005). The re-exposure of deposits at the Hell Gap site in Wyoming also demonstrate the need to present past collections, particularly when little publication was made available in the past (Kornfeld and Larson 2009). Ethics and practice require the constant recognition of the finite nature of the archaeological record, and the use of past collections is just one way to fulfill this professional obligation. The advantage of this practice is that it does not require expensive field work, and assemblages from multiple investigations at a site can be combined. However, the disadvantages may discourage archaeologists from pursuing this source of material. Due to differential recording habits, necessary contextual information may not be available. Archaeologists are also accustomed to completing as much interpretation in the field as in the laboratory

(Scheiber 2008). Also, the use of past collections requires researchers be subject to repository standards regarding the organization and availability of the artifacts. These challenges can inhibit researcher potential, but are necessary for the integrity of the artifact assemblage.

Further Research Needed

Approaching tool-life history analysis of chipped stone tools based on Knudson's (1983) definition of the employable unit, this study attempts to examine the idea of place at Agate Fossil Beds. One of the difficulties in compiling and comparing the above collected data is that lithic analysis rarely explores an approach to chipped stone tools at solely the macroscopic level (beyond typological identification), even though it is the most accessible method available to archaeologists and their students, as well as one requiring the least training (Andrefsky 2005). Unfortunately, a comparable data set based on edges is not available for comparison to affirm or reject the hypotheses created by the results above. Comparable analyses are required from other local High Plains sites, particularly those with more transparent indicators of place persistence, in order to validate the situation at Agate Fossil Beds.

Agate Fossil Beds also suffers from a dearth of investigation and an investigative bias. The majority of investigations conducted at the monument have been federally mandated due to construction projects or for the required park-wide inventory. Wandsnider and MacDonnell (1997) completed an intensive landscape-oriented

investigation of the monument. However, the majority of intensive work has been completed along the Niobrara River. If archaeologists are to begin describing Agate Fossil Beds in terms of what is present, rather than what is missing, further investigation is needed to understand the range of activities completed in this location.

If Agate Fossil Beds contains or became a “place” one expects that location to be in the lowlands, near the Niobrara River. This is supported by the distribution of both formal chipped stone tools and cores. It would also be consistent with the pattern of localities found at other High Plains sites, such as the Casper Site (Frison 1974). Perhaps the remaining question to be addressed is what *kind* of place might Agate Fossil Beds have represented to past peoples?

Conclusion

This thesis presents how Agate Fossil Beds can benefit from a landscape perspective that incorporates elements of time perspectivism and an examination of place through chipped stone tool analysis. While it is now understood that the Plains were indeed occupied prior to the arrival of the horse (Wood 1998), the nature of occupation by highly mobile groups requires further investigation at Agate Fossil Beds. This is particularly relevant in light of its location in a high variance zone (Wandsnider 1999) and due to its proximity to extensively investigated archaeological sites in Wyoming, Colorado, and the Nebraska panhandle. This chipped stone analysis utilized Knudson’s

(1983) employable unit to break down formal chipped stone tools into analytic units focusing on the degree of utilization prior to discard.

What can this data contribute to perceptions of place at Agate Fossil Beds National Monument and to the larger body of research concerned with landscape theory on the High Plains (Scheiber and Clark 2008)? While the evidence for discard of “used-up” tools is inconclusive without similar analyses on assemblages for comparison, the presentation of this data demonstrates one way that the multiscalar nature of landscape and place through the one of the most abundant and persistent artifact types collected.

Archaeology on the Great Plains has traditionally focused on mobility and resource extraction. How can archaeologists move beyond this one dimensional look at a region to a broader landscape approach? Unfortunately, researchers cannot access what individuals in the past were thinking, but it underestimates the social and personal complexity of past peoples to ignore the broader meanings attached to the landscape. Individuals in the past did not make all their decisions based the most efficient ways to make use of the best resource locals; social memory and meanings influenced decisions about where to go and what to do. While archaeologists cannot hear thoughts or see spiritual meanings, it is possible to know more than basic subsistence strategies and economic models from debris of those lives in the past.

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